UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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SUBJECT: Aquifer Designation and Studies - - Ground Water Program Guidance No. 7

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TO: Water Supply Branch Chiefs (I - X)

The enclosed document, Ground Water Guidance No. 7 occurs in two parts:

No. 7.1 - Guidance for the designation of underground sources of drinking water under a State UIC Program;

No. 7.2 - guidance for acceptable State UIC Program work elements for aquifer identification and characterization.

GROUND WATER PROGRAM
GUIDANCE No. 7.1

GUIDANCE FOR THE DESIGNATION OF UNDERGROUND SOURCES OF DRINKING WATER UNDER A STATE UIC PROGRAM

GUIDANCE FOR
THE DESIGNATION OF UNDERGROUND SOURCES
OF DRINKING WATER UNDER A STATE UIC PROGRAM

I. Purpose

The following guidance provides guidance for the minimum acceptable information to be supplied by a State Underground Injection Control Program Director upon the designation of underground sources of drinking water and non-underground sources of drinking water. The minimum information would be provided to support the designations and fulfill public participation requirements.

Also included is guidance for the Administrator of EPA, or his delegated agent to assist in approving the State designations.

II. Background

The Underground Injection Control (UIC) Program regulations will require a State which intends not to regulate certain aquifers, or portions thereof, under the state underground injection control program to formally designate those areas as not falling under the minimum requirements of the UIC program. This designation process is outlined in the preamble to the April 20, 1979, proposed UIC Program regulations, FR Vol. 44, No. 78, page 23743. The proposed UIC Program Regulations, at Section 146.04, sets forth the regulatory requirements for underground sources of drinking water.

III. Guidance for State Directors to Follow in Designations

The nature of the designation process is one of defining boundaries between aquifers being designated underground sources of drinking water and aquifers being excluded as not being underground sources of drinking water. For both types of aquifers, the State, of necessity, will have to give justification for the action. The justification may take the form of the documentation outlined below.

A. Supporting Information for Designating an Aquifer as an Underground Source of Drinking Water

The Director should define those areas of the State which contain aquifers designated as underground sources of

drinking water. Such a definition, at a minimum should include the following:

a) A 1:1,000,000 scale (or comparable scale) map depicting those areas of the State underlain by aquifers designated as underground sources of drinking water.

b) A written narrative including:

1. geologic name/s of the designated aquifer/s;

2. geologic age/s of aquifer/s to the Series level for Cenozoic and the System level for pre-Cenozoic;

3. if the aquifer consists of one or more formations or groups, give the general name applied to the aquifer;

4. define the upper and lower boundaries of the aquifer, i.e., the contact with a certain aquiclude or a general statement of the depth at which 10,000 mg/l - total dissolved solids concentration is generally encountered; and

5. a declaration of whether the aquifer is currently used for drinking water or has TDS concentration of fewer than 10,000 mg/l.

B. Supporting Information for not Designating an Aquifer as an Underground Source of Drinking Water

If the Director determines that an aquifer or part thereof, or a portion of the State, should not be designated as an underground source of drinking water, the Director shall define such areas of the State. Such a definition should include, at a minimum, the following:

a) a 1:1,000,000 scale (or comparable scale) map depicting those areas of the State not underlain by underground sources of drinking water. This information may be included on the same map as that of A(a) above. Multiple maps may be required where

a non-designated aquifer underlies (or overlies) a designated aquifer.

b) A written narrative including:

1. a declaration of the non-existence of any sources of drinking water derived from ground water in the proposed subsurface zone or aquifer. This includes drinking water supply wells and surface water sources of drinking water which have a ground-water contribution such as base flow, springs, seeps, etc; and

2. the reason/s for excluding the area/s from designation. This reason/s must be one or more of the following:

a) the ground water has a TDS concentration greater than 10,000 mg/l;

b) the aquifer is mineral, hydrocarbon or geothermal energy producing;

c) the aquifer is situated at a depth or location which makes recovery of water for drinking purposes economically or technologically impractical; or

d) the aquifer is so contaminated that it would be economically or technologically impractical to render the water fit for human consumption.

For each of the above reasons cited in the Director's supporting information for not designating an aquifer, the data should be included which was used to arrive at the decision.

C. Public Participation Requirements

Due to the importantance attached to the designation process in the overall State UIC Program, and the implications of not designating certain aquifers, public participation should be an integral part of this process.

The State Director shall follow the public participation procedures outlined in 40 CFR Part 146, Preamble, page 23741, FR Vol. 44, No. 78, and as stipulated in 40 CFR Part 123.

IV. Guidance for the Approval of State Designations by the Administrator

Prior to final approval of a State UIC program, the Administrator of EPA, or his delegated agent, shall review the proposed State designations of underground sources of drinking water and non-underground sources of drinking water, making the determination whether the State designations are adequate to protect underground sources of drinking water within the State. (Further guidance to the Administrator is forth coming from the technical contractor).

V. Implementation

Regional Administrators will utilize this guidance in providing a State UIC Program Director with the minimum requirements to be met for the designation process. Also, this guidance will be followed during EPA review of State UIC Program designations to determine acceptability of such a program.

VI. Filing Instructions

This guidance document should be filed as Ground Water Program Guidance No. 7.1 .

VII. Action Responsibility

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GROUND WATER PROGRAM
GUIDANCE No. 7.2

GUIDANCE FOR ACCEPTABLE STATE UIC PROGRAM WORK ELEMENTS FOR AQUIFER IDENTIFICATION AND CHARACTERIZATION

GUIDANCE FOR
ACCEPTABLE STATE UIC PROGRAM WORK ELEMENTS
FOR AQUIFER IDENTIFICATION AND CHARACTERIZATION

I. Purpose

The objective of the Underground Injection Control (UIC) Program is to protect underground sources of drinking water from contamination by well injection. Included in this is the intent to protect these sources not only for present users but for future users as well. In order to implement such a UIC program (as well as other ground-water related programs under the Resource Conservation and Recovery Act), the ground-water resource in that State must be identified and characterized to provide the basis for future decision making. This guidance sets forth a partial listing of acceptable State UIC Program work elements.

II. Background

To assist the States in obtaining this basis for decision making, the Underground Water Source Protection grant funds can be utilized. The following guidance suggests many possible areas in which the State can begin to collect information if not already available. The guidance also is presented so as to maintain a certain degree of national consistency in the data collection and presentation. With the limited funds available, only a small portion of the elements in this guidance could be completed or even begun. Where a State already has an existing program with many of the elements at hand, that State could start work on other elements. Many of these elements are longer term and could not be completed in one year; therefore the ongoing, data collection nature of these elements is stressed and progress towards gaining a more complete knowledge of the resource as time passes is the objective.

The need for a flexible approach to the collection of this data base is recognized, since the hydrogeologic variation across the country is great. To this end, this guidance is an attempt to strike a balance between the need for national consistency and individual State flexibility.

The problem with attempting to maintain national consistency in this guidance is the great difference between

East and West. States in the East are generally humid and water surplus areas relative to the States in the West. It is recognized that certain areas in the East have quantity problems due to over withdrawals. Likewise, water laws generally differ between East and West. Riparian/reasonable use doctrines prevail in the East, while appropriative rights prevail in the West. The following guidance for identification and characterization of aquifers is geared toward a flexible approach to allow the States to address their unique situations.

In any State UIC program, a determination should be made concerning the minimum criteria for an aquifer which would qualify it as an underground source of drinking water. Certain minimum criteria already exist in that Congress intended that ground water containing less than 10,000 mg/l TDS would be protected, and that ground water already used for drinking water would be protected. Other criteria which may be involved in decision making include specific yield or storage coefficient, saturated thickness or available drawdown, transmissivity, and depth. Also involved in the designation process are considerations for historical precedent (areas allowed to become contaminated previously) and water use rights.

The following guidance provides potential work elements in an acceptable State UIC program for approval of Federal grant funds. This guidance is not all-inclusive nor are these elements needed in every State. The State is the best judge for what work elements and activities are top priority to the successful operation of a UIC program. It should be noted that in any such endeavor as described here, the first order of business would be to assemble all existing information prior to generating new data. This will help identify the gaps in present knowledge. Coordination with the U.S.G.S. should also be stressed as the U.S.G.S. is and has been conducting similar studies as outlined here.

III. Guidance on Acceptable Work Elements for Aquifer Identification and Characterization

A. Aquifer Definition

The State will need to define an aquifer in terms of the State's particular hydrogeologic conditions. The proposed UIC program regulations utilize the standard definition;

"Aquifer" means a geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield or be capable of yielding usable quantities of ground water.

This definition provides for considerable flexibility for the States. As discussed in section A, the State will determine the minimum criteria for designation of aquifers. The State must interpret the meaning of "usable quantities of ground water" within the context of the above definition.

One method of aquifer definition could be based on hydraulic conductivity (K). For example, both Davis and DeWiest (1966, Table 6.1) and Todd (1959, Fig. 3.4) define "good aquifers" as having K values greater than about 10 gpd/ft^2 and "poor aquifers" as having K values less than 10 gpd/ft^2. Todd further classifies "impervious material" as having K values less than about $10^{-3} gpd/ft^2$. Another method could be based on the definition of minimum yields to wells, e.g., 1.0 gpm or 3.0 gpm expected yield to a well. However, this does not consider different technologies for increasing yields. In some parts of the country people depend on a ground-water supply which would be considered a non-aquifer in other parts of the country due to differences in water availability.

B. Types of Data on Underground Drinking Water Sources

a) A map which depicts the areas of the State with aquifers containing ground water up to 10,000 mg/l TDS. A map could be drawn depicting TDS isocons (map showing contour lines indicating equal concentration of TDS).

b) A map which depicts the depth to the base of underground sources of drinking water (i.e., at what depth is 10,000 mg/l TDS encountered).

c) Many geologic environments contain multiple aquifers layered vertically (e.g., Atlantic Coastal Plain). For these regions, a separate map may be needed for each aquifer to delineate their areal extent and quality.

d) To properly show TDS of ground water in aquifers, appropriate vertical cross-sections are needed to display changes in TDS with depth within the same aquifer, such as in cases of saline intrusion or natural increases in TDS with depth.

e) The scale of these maps could be at 1:500,000 (one inch equals about sixteen miles). Base maps at this scale are available from the USGS. For convenience, the larger States (i.e., Alaska, Texas, and California) could use a smaller scale such as 1:2,500,000. The State may wish to use a larger scale map for individual aquifers or parts thereof to properly display the information.

f) Horizontal and vertical scales for cross-sections should be such that vertical exaggeration (i.e., horizontal scale divided by vertical scale) is not greater than 100 times. For example, a cross-section with vertical scale of 1" = 50' and horizontal scale of 1" = 5000' has a vertical exaggeration of 100.

C. Aquifer Thickness and Elevation Maps

a) Contour map indicating elevation of top of aquifer. Contour intervals used will depend upon specific circumstances and is left to State discretion.

b) Contour map indicating elevation of base of aquifer.

c) An isopach map of the aquifer (map showing contour lines indicating equal thickness).

d) Contour map showing elevation of water table in unconfined aquifer or potentiometric surface in confined aquifer.

e) Information on historic changes in water levels over the past 20 years or since about 1960. The State should coordinate these studies in e) and f) with activities under Section 208 of The Clean Water Act and any U.S.G.S. studies.

f) Information on projected changes in water levels for about 20 years into the future or the year 2000, or some other applicable time interval.

g) Contour map showing saturated thickness of aquifer.

D. Hydrogeologic Descriptive Narrative

A written narrative could be prepared describing the hydrogeology of each aquifer identified in section B. The

following topics could be addressed:

a) Geologic column of State or parts of State showing aquifers and aquitards and formation names.

b) Lithology of aquifers.

c) General structure of aquifer (joints, faults, folds and attitude or strike and dip).

d) General hydrology of aquifer including data on average hydraulic conductivity, saturated thickness, observed yields to wells possible, and general ground-water flow directions.

e) General discussion of hydrocarbon, mineral or geothermal potential in the State. Generalized maps and geologic columns depicting the areas and zones of hydrocarbon, mineral or geothermal potential.

f) Discussion of ground-water quality of each aquifer including tabulation of average and range for major and trace inorganic and organic (where known) constituents. Delineation of aquifers or areas of aquifers naturally or artificially contaminated by other than TDS (by means of map or narrative). Map scale left to discretion of State.

E. Coordination and Compatibility with other State and Federal Programs

Address the relationship of the State UIC program with any other similar programs to be carried out by the State such as under the Resource Conservation and Recovery Act, Toxic Substances Control Act or Clean Water Act. Discuss how coordination will be affected at the State level and how compatibility between the different programs will be accomplished.

F. Analysis of Legal Constraints

Analyze the relationship of the State UIC program to State ground-water law. Cite and describe existing ground-water laws. Discuss the impact of any aquifer not designated to be protected upon water use and ground-water rights.

G. Aquifer Use Data and Maps

Collection of information on water use for each aquifer including:

a) Location of public water supply wells, domestic wells to the extent possible, industrial and agricultural (irrigation) wells, and other drinking water wells (by latitude/longitude or township/range).

b) Data on average rate of withdrawal (in gpm or gpd) for above wells;

c) Data on depths of wells located in a) above;

d) Maps for each aquifer locating wells in a) above.

e) Other data deemed appropriate. Refer to the USGS Ground Water Site Inventory, and a 200 page guidance entitled National Water Data Storage and Retrieval System, USGS Open-File Report 75-589, November 1975 (not enclosed).

H. Demographic Analysis

a) Illustrate current population dependent on each aquifer for drinking water.

b) Make projections of population relying on each aquifer for years 2000 and 2020. The State should coordinate these activities with work under Section 208 of the Clean Water Act and the U.S.G.S.

c) Percentage of population using ground water by county. Possible ranges are: 0-25%, 26-50%, 51-75%, 76-100% dependence.

I. Economic and Technical Feasibility Analyses

For any aquifers identified in section B which are not currently used, discuss the feasibility of producing ground water from each of those aquifers based on economic and technical considerations. Economic considerations involve the presence of other, cheaper sources of drinking water. Technical considerations could include assessment of the practicality of developing resources because of depth, yield or distance from area of need.

IV. Implementation

Regional Administrators will take this guidance, Groundwater Program Guidance #1 and the applicable grant regulations into account in negotiating and approving State UIC Program work plans. This guidance follows up and expands on Ground Water Program Guidance #1, Part 1. Identification of Underground Sources of Drinking Water.

V. Filing Instructions

This guidance document should be filed as Ground Water Program Guidance No. 7.2 .

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References

Davis, S.N., and R.J.M. DeWiest, 1966, Hydrogeology, John Wiley and Sons, Inc., New York.

Todd, D.K., 1959, Ground Water Hydrology, John Wiley and Sons, Inc., New York.